Three New Species of *Salacia* from Mesoamerica (Celastraceae, Salacioideae)

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Abstract. Three new species of *Salacia* L. from Mesoamerica (Celastraceae, Salacioideae) are described from Panama. *Salacia macrocremastra* Lombardi is characterized by its very long pedicels to 50 mm, large flowers to 19 mm diam., and slightly bullate, elliptic leaves with a rounded base. *Salacia mennegana* J. Hedin ex Lombardi is distinguished by its buds with the calyx initially truncate and lobes that grow as the flower expands during anthesis, open inflorescences, annular disk, and ellipsoid fruits. *Salacia panamensis* Lombardi can be recognized by its closed calyx with lobes that are irregular in bud and that tear apart as the flower opens, and its annular-pulvinate, slightly pentagonous disk with outer margin flattened.

Resumo. São descritas para a região Mesoamericana três novas espécies de *Salacia* L. do Panamá (Celastraceae, Salacioideae). *Salacia macrocremastra* Lombardi é caracterizada pelos seus pedicelos muito longos de até 50 mm, flores grandes de até 19 mm diâm., e folhas elípticas, levemente buladas e de base arredondada. *Salacia mennegana* J. Hedin ex Lombardi distinguida pelos botões com cálice inicialmente truncado e lobos que crescem conforme a flor se expande na antêse, inflorescências laxas, disco anular e frutos elipsóides. *Salacia panamensis* Lombardi que pode ser reconhecida pelo cálice fechado no botão, com lobos irregulares que se separam conforme a flor abre, e pelo disco anular-pulviniforme, levemente pentágono e de margem externa achatada.

Key words: Celastraceae, IUCN Red List, Mesoamerica, *Salacia*, Salacioideae.

Celastraceae currently include the former family Hippocrateaceae divided in two subfamilies, the Hippocrateoideae, with 19 genera and ca. 100 species, and the Salacioideae, with six genera and ca. 260 species (Simmons, 2004) distributed worldwide in tropical and subtropical areas.

The limits between genera are controversial in the Hippocrateaceae, and their recognized numbers range from two, *Salacia* L. and *Hippocratea* L. (Peyritsch, 1878), to 25 (Simmons, 2004). This work follows the current concept that splits Neotropical Hippocrateoideae into eight genera, *Anthodon* Ruiz & Pavón, *Cuervea* Triana ex Miers, *Elachyptera* A. C. Smith, *Hippocratea*, *Hylenaea* Miers, *Prionostemma* Miers, *Pristimera* Miers, and *Semialarium* N. Hallé; and Salacioideae in four genera, *Cheiloclinium* Miers, *Peritassa* Miers, *Salacia*, and *Tontelea* Miers (Smith, 1940; Mennega, 1997; Simmons, 2004).

Salacia is a genus with ca. 200 species (Mennega, 1997), with Smith (1940) recognizing 29 species from the Neotropics. Mennega (1984, 1991) later described four other species and Lombardi (2007) another four. The last comprehensive taxonomic study of the genus, although unpublished, is by Hedin (1999), who recognized 38 species in the Neotropics, 20 with fasciculate inflorescences, including two new taxa from Ecuador and Peru.

The probable paraphyly of *Salacia* s. str. was pointed out by recent molecular studies (Simmons et al., 2001a, b). Worldwide analyses of representative species from both the Old and New Worlds are still needed before any generic realignment can be proposed.

While working on the monographic treatment of Hippocrateaceae for the Flora Mesoamericana Project, I encountered all 12 genera, with at least 28 species, and here recognize three new *Salacia* species.

1. Salacia macrocremastra Lombardi, sp. nov. TYPE: Panama. Darién: Parque Nac. Darién, ridge betw. Río Topalisa & Río Pucuro, ca. 17 km E of Pucuro, La Laguna area, 08°03′N, 77°17′W, 750–850 m, 18 Oct. 1987, *B. Hammel, G. de Nevers, H. Cuadros & H. Herrera 16285* (holotype, MO; isotype, PMA). Figure 1.

Haec species *Salaciae grandifoliae* (Martius ex Schultes) G. Don, *S. juruanae* Loesener et *S. macranthae* A. C. Smith foliis magnis (22–43.5 × 5.6–13.4 cm) et inflorescentiis fasciculatis affinis, sed a his duabus floribus majoribus (ca. 19 mm diam. sub anthesi), ab omnibus pedicellis longioribus (40–50 mm longis) et foliis bullatis ad basin rotundatis differt. Etiam ab eis omnibus distributione geographica ad Panamam endemica distincta.

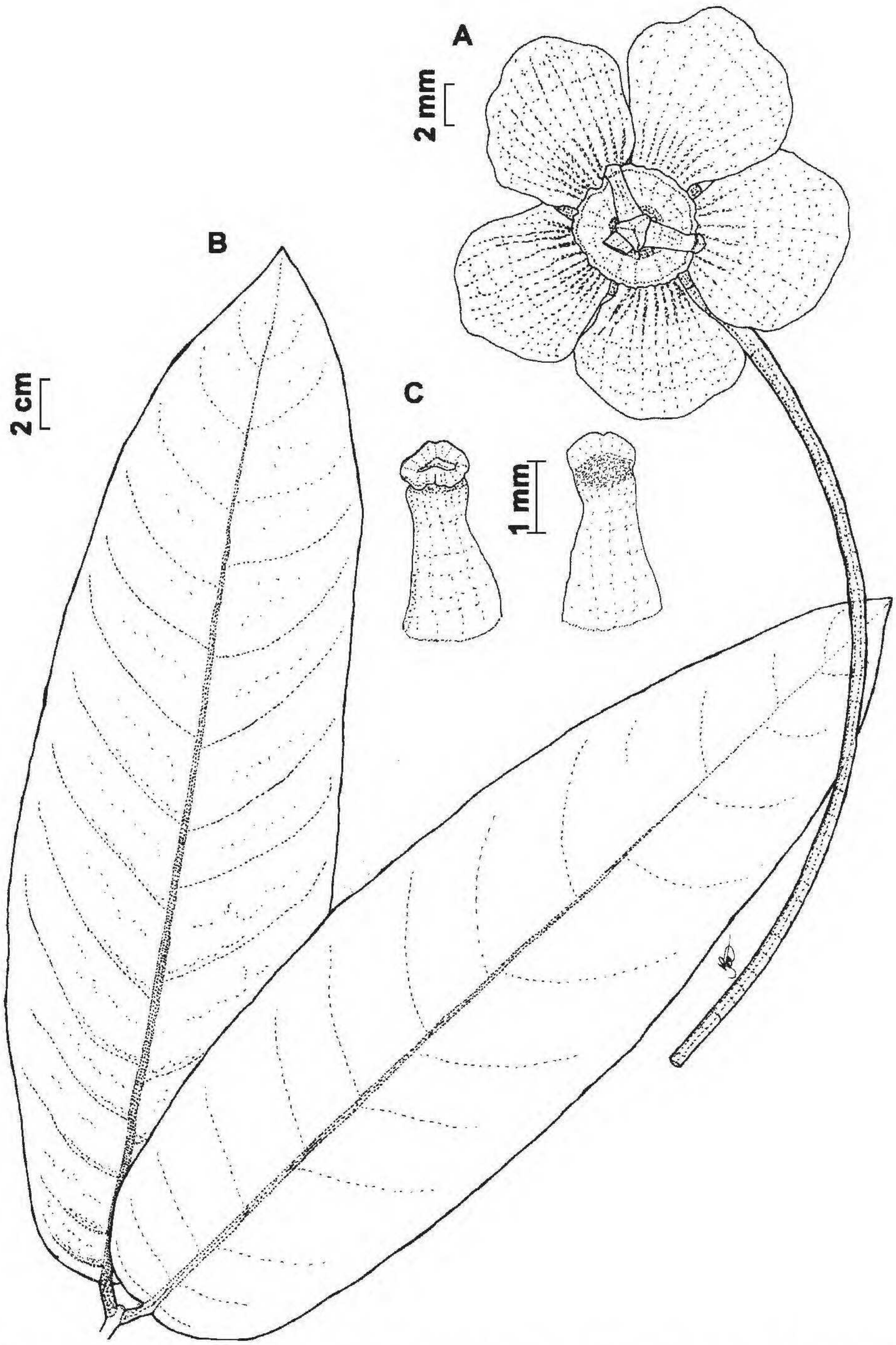

Figure 1. *Salacia macrocremastra* Lombardi. —A. Apical view of flower, with one stamen missing. —B. Branch with leaves. —C. Adaxial and abaxial view of stamen. A–C drawn from the holotype *Hammel et al. 16285* (MO). Drawings by the author.

Lianas, glabrous, branches subterete, new growth ones flattened, smooth to sparsely lenticellate, drying light brown to yellowish, surface rigid, fissured in irregular plates, old ones cylindric, sparsely lenticellate, fissured, drying brown. Leaves opposite to subopposite; stipules 0.4–0.7 mm, triangular, caducous; petioles 10–29 mm, obscurely canaliculate, drying wrinkled and brown; blades 22–43.5 × 5.6–

13.4 cm, elliptic, with rounded or reniform base, apex acute or rarely acuminate or emarginate, margin entire, thickened, slightly revolute, slightly bullate, chartaceous, drying olive-green or light brown on both sides, venation brochidodromous with veins immersed on adaxial side, prominent on abaxial side, secondary veins immersed or plane on abaxial side, plane or slightly prominent on abaxial side, tertiary veins invisible on both sides. Inflorescence fasciculate, with 2 to 4 flowers, ramiflorous on leafless nodes or trunciflorous; bracts inconspicuous, scalelike, fimbriolate; pedicels 40–50 mm, terete. Flower bud unknown; open flowers cream, tannish pink, or dull green with brown center, ca. 19 mm wide at anthesis; sepals 5, 2.6–2.8(–3.7) × 3.1–3.3(–4.2) mm, elliptic, cucullate, margin entire; petals 5, 7.5–7.7 × (7.7–) 8.6–8.8 mm, widely elliptic, unguiculate, spreading at anthesis; petals dull green at tip, grading to brownish purple at base, margin entire; disk ca. 0.5 × 2–2.2 mm, patelliform, carnose, outer margin wrinkled, internal margin raised, drying brown; stamens 3, 2.6–2.8 mm, filaments 1.9–2 mm, flattened, slightly larger at the apex; anthers 0.65–0.75 × 0.85–0.9 mm, oblong, basifixed, bilocular, dehiscence by apical slits bent at ca. 90°, connective apex triangular, conspicuous; pistil pyramid-shaped, ovary ca. 1.8 mm wide, 3-angled, 3-locular, with 6 ovules in each locule, style obsolete, stigmas obscure, punctiform, orange. Berries not seen; seeds not seen.

Distribution and habitat. *Salacia macrocremastra* is apparently restricted to Panama, where it occurs at altitudes of 650–850 m and was reported in disturbed remnants of premontane wet forest and in forest along ridges and streams. This species is reported to occur inside the Parque Nacional del Darién (*Hammel et al. 16285*) and is protected, at least to a certain extent. Nonetheless, it is considered Endangered (EN) according to IUCN Red List criteria because its area of occurrence is less than 5000 km^2, it is known to occur at only three locations, and a continuing decline of its area of occupancy is inferred for habitat fragmentation (IUCN, 2001).

Phenology. The new species has been collected with flowers in January, April, and October; fruits not seen.

Etymology. The specific epithet refers to the very long pedicels, which are unique among *Salacia* species in the New World.

Discussion. *Salacia macrocremastra* strongly resembles *S. grandifolia*, *S. juruana*, *S. gigantea* Loesener, *S. macrantha*, and the here-described *S. panamensis* Lombardi because of its large leaves, and *S. macrantha* because of its large flowers. Nevertheless, *S. grandifolia* is restricted to Brazilian Atlantic rainforests and has smaller flowers (14.5–16.3 mm) with shorter pedicels (3–11 mm); *S. juruana* and *S. gigantea* are restricted to the rainforests of the Amazon Basin and have smaller flowers (9–18 mm) with shorter pedicels (1–19 mm); *S. macrantha* is restricted to the rainforests of the Amazon Basin and has larger, yellow-green flowers (18–24 mm) with shorter pedicels (6–22 mm); and *S. panamensis* has smaller flowers (11–13 mm) with shorter pedicels (9–10 mm) and a peculiar calyx with fused sepals. None of the above species have bullate leaves with a rounded or reniform base, as seen in the new species.

The frequency of browsed stamen apices, which are probably eaten by insects, suggests that the filament apex or the connective itself may be nectariferous.

Among the Neotropical *Salacia* species, this species is notable for having the longest pedicels (to 50 mm), followed by *S. kanukuensis* A. C. Smith (19–27 mm) and *S. odorata* Lombardi (20–24 mm).

Paratypes. PANAMA. **Coclé:** El Cope, W of sawmill, 5 Apr. 1978, *B. Hammel 2387* (MO, PMA). **Panamá:** 6.5 km by rd. N of Lago Cerro Azul, 650–730 m, 13 Jan. 1974, *M. Nee 9289* (MO, PMA).

2. Salacia mennegana J. Hedin ex Lombardi, sp. nov. TYPE: Panama. Darién: S of El Real, Alturas de Nique, near Cana mine, along trail following old Camino Real toward Colombia, 07°45′N, 77°40′W, 24 Aug. 1987, *G. McPherson 11577* (holotype, MO; isotypes, MEXU, PMA). Figure 2.

Haec species quoad inflorescentiam ramosam *Salaciae opacifoliae* (J. F. Macbride) A. C. Smith et *S. insigni* A. C. Smith similis, sed a hac foliis in sicco brunneis et petiolis brevioribus, ab illa inflorescentia laxiore, ab ambabus calyce gamosepalo differt. Etiam ab ambabus distributione in Colombia Panama et Costa Rica (nec in sylva amazonica) differt.

Liana, glabrous, branches terete to subterete, new growth ones conspicuously flattened, sparsely or minutely lenticellate, drying grayish brown, old ones cylindric or subcylindric, fissured, dense or sparsely minutely lenticellate, drying brown. Leaves opposite to subopposite; stipules 0.4–0.5 mm, triangulate, caducous; petioles 2(–3) mm, obscurely canaliculate, drying black; blades (3.8–)8.1–14.8 × (0.9–)2.7–6.2 cm, elliptic, with rounded base, apex long acuminate to acuminate, margin entire, thickened, and cream colored, chartaceous, drying dark brown on the adaxial side, light brown on the abaxial side, venation brochidodromous with veins plane on adaxial side, secondary veins raised on abaxial side, prominulous on abaxial side, tertiary veins plane or

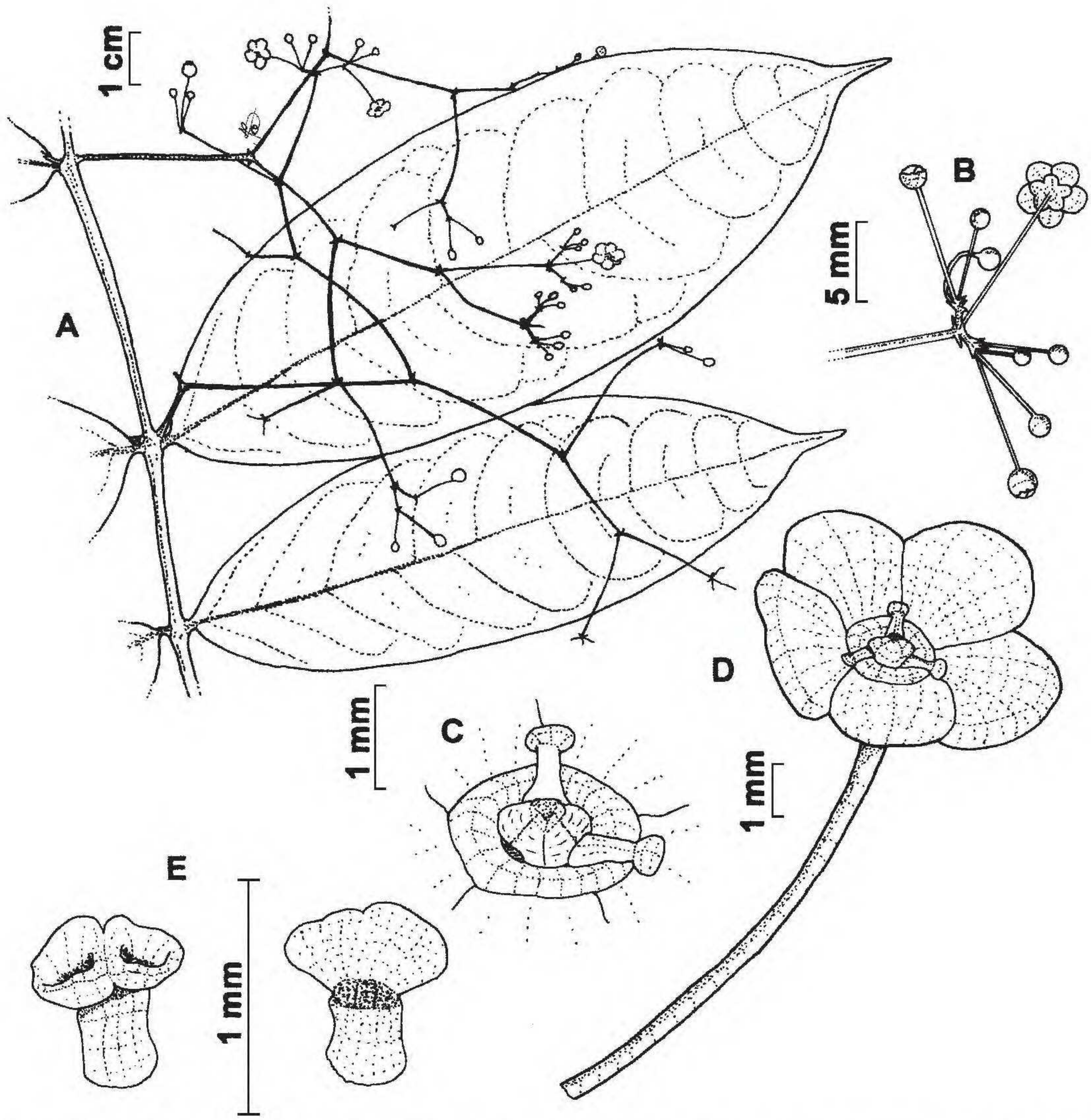

Figure 2. *Salacia mennegana* J. Hedin ex Lombardi. —A. Branch with leaves and inflorescences. —B. Detail of inflorescence and buds, showing the underside of the calyx. —C. Lateral view of disk, stamens, and pistil, with one stamen removed. —D. Apical view of flower. —E. Adaxial and abaxial view of stamen. A–E drawn from the holotype *McPherson 11577* (MO). Drawings by the author.

invisible. Inflorescence (2.6–)4.7–8(–10.9) × 5.2–9 (–19.9) cm, a slender compound dichasia, with 24 to 56 flowers, sometimes on leafless nodes; peduncles 1–2(–15) mm, terminal aggregated inflorescences with peduncles up to 51 mm, flattened, lenticellate, branches opposite; bracts 0.8–1.1 mm, triangular, margin scarious, minutely erose; pedicels (5.5–)8–10.3 mm, terete. Flower bud spherical; open flowers orange to pale brown, 4–6.5 mm wide at anthesis; calyx in bud tubular, truncate, ca. 1.3 × 2.3 mm, lobes 5, growing at anthesis, 0.8–1.1 × 1.1–1.3 mm, elliptic, margin minutely papillose; petals 5, 2.3–3.1 × (2.2–)2.7–3.8 mm, widely elliptic to transverse elliptic, unguiculate, ± carnose, spreading at anthesis, brown to orange, drying brown, margin minutely denticulate; disk 0.2–0.3 × 0.4–0.6 mm, annular, slightly pentagonous, carnose, outer margin rounded, orange-brown to dark orange; stamens 3, 0.8–1.1 mm, filaments 0.5–0.9 mm, flattened, anthers 0.25–0.5 × 0.6–0.7 mm, reniform, basifixed, bilocular, dehiscence by apical slits bent at ca. 120°, pistil pyramid-shaped, ovary ca. 0.8 mm wide, 3-angled, 3-locular, with (4)5 ovules in each locule, style obsolete, stigmas obscure, punctiform. Mature berries

(3.2–)5.5–6.9 × 2.5–3 cm, ellipsoid, exocarp crustaceous, ca. 1.4 mm thick, yellow-orange, drying slightly tuberculate and dark brown; seeds 1.5–2 × ca. 0.8 cm, ellipsoid, enclosed in colorless and translucent pulp.

Distribution and habitat. *Salacia mennegana* is apparently restricted to Colombia, Panama, and Costa Rica, where it occurs at altitudes of (100–)850–1100 m and has been reported in tall, selectively logged forest and forested slopes. This species is not reported inside any official conservation unit and is thus unprotected. It is considered Vulnerable (VU) according to IUCN Red List criteria because its area of occurrence is less than 5000 km^2, it is known to occur at fewer than 10 locations, and a continuing decline of its area of occupancy is inferred for habitat fragmentation (IUCN, 2001).

Phenology. The new species has been collected with buds and flowers in February, August, and November, and with mature fruits in April.

Etymology. The specific epithet honors Alberta Maria Wilhelmina Mennega, wood anatomist and distinguished taxonomist of New World Hippocrateaceae.

Discussion. *Salacia mennegana* resembles *S. opacifolia* and *Peritassa pruinosa* (Seemann) A. C. Smith because of its leaf shape, short petioles, and the color of the dried leaf blade; it is difficult to distinguish with only vegetative material. Nevertheless, *S. mennegana* can be recognized by its looser inflorescences (vs. inflorescences 0.8–3.1 × 0.5–4.3 cm in *P. pruinosa* and 0.9–3.4[–5.1] × 0.5–1.5[–6.9] cm in *S. opacifolia*) and fused sepals (vs. typical Salacioideae with free sepals in the other two species).

Salacia mennegana differs from *S. insignis*, which also has loose branched inflorescences, by its leaves that dry brown (vs. green), its shorter petioles (vs. 4–18 mm), and its fused sepals.

Jennifer Hedin recognized this species in her dissertation and intended to name it in honor of Dr. Mennega (as "*mennegae*"; Hedin, 1999: 176), but this name has remained unpublished to date. Hedin (1999) noted that this species is closely related to *Salacia insignis* and *S. opacifolia* because of their similar branched inflorescences and floral morphology.

Paratypes. COLOMBIA. **Chocó:** Jequedó, 41 km W of Las Animas on Pan-American Hwy., ca. 10 km E of Río Pato, 220 m, 12 Jan. 1979, *A. Gentry & E. Renteria A. 24101* (MO [2]). COSTA RICA. **Puntarenas:** Osa Peninsula, Aguabuena, 3 km W of Rincón, 08°42′N, 83°30′W, 130 m, 17 Apr. 1993, *K. Thomsen 349* (C, U); 10 Aug. 1994, *Thomsen 987* (NY). PANAMA. **Panamá:** 8 km N of Cerro Azul on rd. to Cerro Jefe, 732 m, 13 Nov. 1965, *K. E. Blum, R. K. Godfrey & E. Tyson 1689* (MO); near continental divide, valley of Río Mamoni, 16 km by rd. N of Chepo, ca. 09°20′N, 79°08′W, ca. 400 m, 21 Feb. 1986, *G. McPherson 8470* (MEXU, MO); along El Llano–Carti rd., ca. 7.4 km from Pan-American Hwy., ca. 09°15′N, 79°00′W, ca. 350 m, 22 Aug. 1986, *G. McPherson 9958* (MO, PMA).

3. Salacia panamensis Lombardi, sp. nov. TYPE: Panama. Panamá: Cerro Jefe, along rd. to summit, 09°15′N, 79°30′W, 12 Dec. 1986, *G. McPherson 10018* (holotype, MO; isotype, PMA). Figure 3.

Haec species quoad folia magna et inflorescentiam fasciculatam *Salaciae grandifoliae* (Martius ex Schultes) G. Don et *S. juruanae* Loesener similis, sed a hac habitu non scandenti, ab ambabus calyce in alabastro clauso sub anthesi in lobos 5 irregulares diviso et floris aperti colore pallide-viridi centro brunneo differt. Etiam distributione geographica distincta ad Panamam endemica differt.

Trees 4–10 m high or treelets 2–4 m high, glabrous, branches subterete, new growth ones cylindric, compressed in the nodes, not lenticellate or sparsely lenticellate, shiny, drying ochre or brown, minutely wrinkled, old ones cylindric, fissured, lenticellate, shiny, drying brown-red. Leaves opposite to subopposite; stipules not seen, caducous; petioles 10–27 mm, obscurely canaliculate, drying wrinkled and black; blades 17.2–30.7(–39.5) × (7.9–)10–18 (–19.3) cm, elliptic, base rounded or cuneate, apex acute, rarely obtuse, margin entire, thickened, slightly revolute, chartaceous, yellow-green on abaxial side, drying brown or olive-brown on both sides, venation brochidodromous with veins prominent on both sides, secondary veins plane or immersed on abaxial side, invisible on adaxial side, tertiary veins invisible on both sides. Inflorescence a contracted brachyblast and apparently fasciculate, with 2 to 4 flowers, ramiflorous on leafless nodes or trunciflorous; bracts inconspicuous, scalelike, fimbriolate; pedicels 9–10 mm, terete. Flower bud spherical; open flowers pale green with brown center, 11–13 mm wide at anthesis; calyx closed in very young buds that grow tearing into 5 irregular lobes, lobes (1.8–)2.3–3.1 × (2–)2.3–2.4 (–3.4) mm, triangular, margin minutely irregular, dried and black; petals 5, 4.4–4.8(–6.3) × 3.4–4.4 (–5.4) mm, obovate, carnose, spreading at anthesis, pale green with brown at its base, base probably nectariferous, margin entire; disk 1.3–1.8 × ca. 0.9 mm, annular-pulvinate, slightly pentagonous, carnose, orange, brown, or pale red, outer margin flattened, drying dark brown; stamens 3, 1.4–1.8 mm, filaments 1.1–1.4 mm, flattened, anthers 0.3–0.45 × 0.5–0.6 mm, reniform, orange, basifixed, bilocular, dehiscence by apical slits bent at ca. 120°; pistil pyramid-shaped, ovary ca. 1.5 mm wide, 3-angled, white or pink-white, 3-locular, with 5 ovules in each

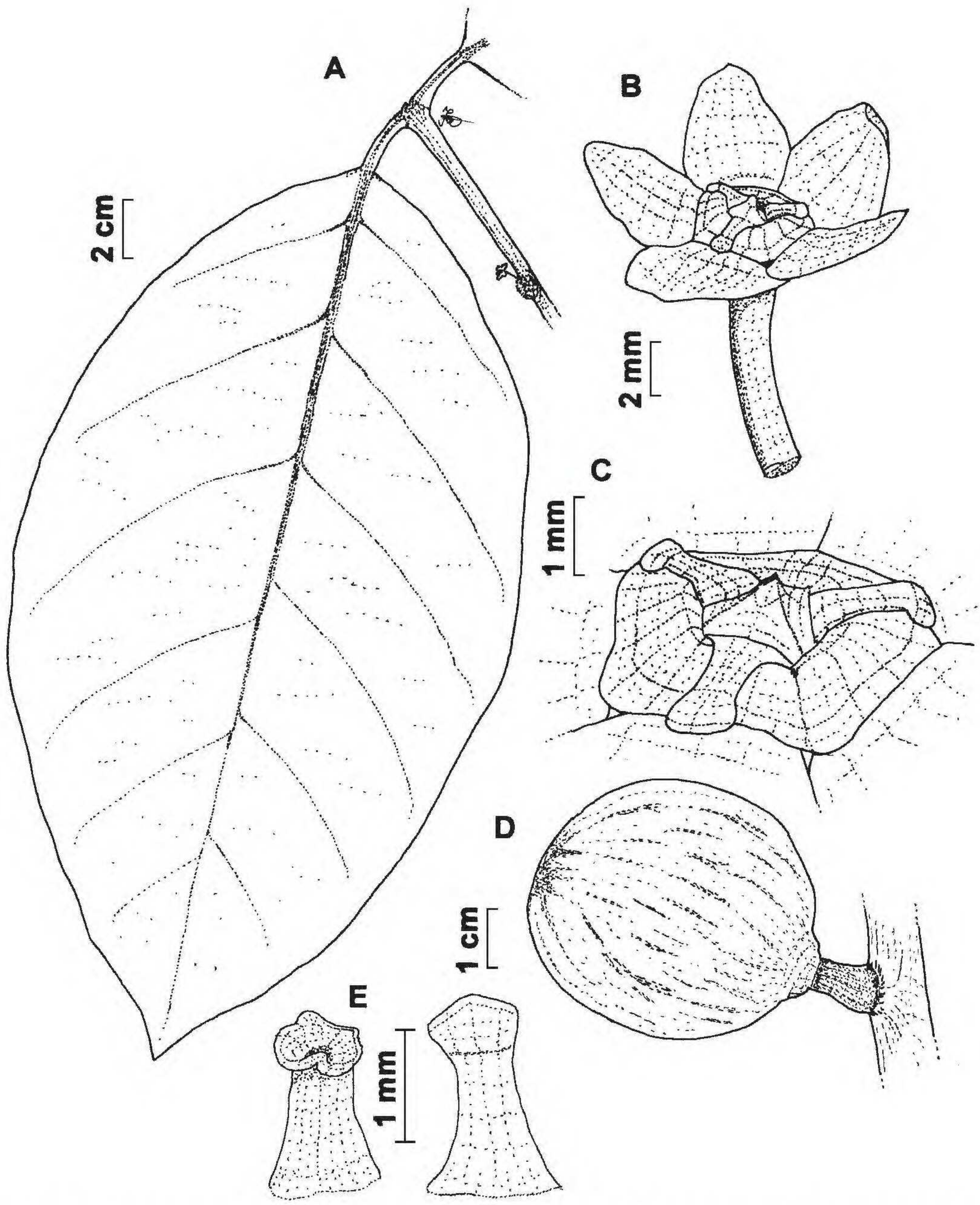

Figure 3. *Salacia panamensis* Lombardi. —A. Branch with leaves. —B. Apical view of flower. —C. Lateral view of disk, stamens, and pistil. —D. Mature fruit. —E. Adaxial and abaxial view of stamen. A drawn from *Galdames 4149* (MO); B, C, E drawn from the holotype *McPherson 10018* (MO); D drawn from *Mori & Kallunki 5482* (MO). Drawings by the author.

locule, style obsolete, stigmas obscure, punctiform. Entire mature berries not seen, immature berries 3.6–4.8 × 2.2–4.4 cm, spherical, exocarp coriaceous, immature green with grayish striations, mature yellow, drying brown; seeds ca. 1.1 × 0.9 cm, ellipsoid, orange, enclosed in white and translucent pulp.

Distribution and habitat. *Salacia panamensis* is apparently restricted to Panama, where it occurs at altitudes of 200–300 to 800–1000 m and was reported in cloud forests, premontane wet forests, secondary forest, and riverbank lowland rainforests, in transition to premontane forests. This species is reported to

occur inside the Parque Nacional Altos de Campana (*Galdames 4149* and *4380*) and has a protected status, nonetheless it is considered Vulnerable (VU) according to IUCN Red List criteria because its area of occurrence is less than 5000 km², it is known to occur at no more than 10 locations, and a continuing decline of its area of occupancy is inferred for habitat fragmentation (IUCN, 2001).

Phenology. The new species has been collected with buds and flowers from December to February, and in April, August, and September; it has been collected with mature fruits in April, August, and November and with immature ones in December.

Etymology. The specific epithet refers to the country where this species is apparently endemic.

Discussion. The inflorescence of *Salacia panamensis* is not a true fascicle, but a very contracted brachyblast with successive flowerings, the oldest being bigger and higher than the newest, which was presumably produced in the year of specimen collection. Hedin (1999: 72) describes this inflorescence type as a "highly contracted cyme."

Salacia panamensis strongly resembles *S. grandifolia* because of its large leaves (blades [10.4–]25.8–29[–32] × [5.1–]5.5–7.9[–15] cm in *S. grandifolia*) and habit and *S. juruana* because of its large leaves (blades [10.1–]17.6–25.6[–46.5] × [3.8–]4.8–7.5 [–14.7] cm in *S. juruana*). However, *S. grandifolia* is restricted to Brazilian Atlantic rainforests, and *S. juruana* is restricted to rainforests of the Amazon Basin. In addition, both species have sepals that are not initially connate, but developmentally free with fimbriolate margins.

The base of the petals is probably nectariferous, and copious nectar was reported on the flowers (*Knapp 1354*). In studied specimens, the petal bases were often scraped by insects.

Hedin (1999: 59) recognized the peculiar calyx of both *Salacia mennegana* and *S. panamensis* in her dissertation and associated it with the calyptra-like calyx of the Malaysian species of *Salacicratea* Loesener. She described the calyx of *Salacia mennegana* as "...a smooth sheath over the bud, but as the flower expands, this sheath tears into five or sometimes more unequal to subequal parts" and the calyx of *S. panamensis* (not named by her) as a "...three-parted calyx in which the segments are valvate... ." In my interpretation, the calyx segments of *S. mennegana* do not tear apart but grow into separate lobes, which is strongly suggested by the papillose margins. In addition, the lobes of *S. panamensis* do not start as free valvate parts, but as a closed bud in which the growing flower center bursts the segments apart. This is supported by the irregular and dried black margins of the calyx lobes.

Paratypes. PANAMA. **Colón:** Santa Rita ridge, SE of Colón, ca. 19 rd. km from Trans-Isthmiam Hwy., 09°25′N, 79°40′W, ca. 500 m, 17 Sep. 1987, *G. McPherson 11761* (MO). **Darién:** Cerro Pirre, 760–1370 m, 9–10 Aug. 1967, *J. A. Duke & T. S. Elias 13713* (MO); N slopes of Cerro Pirre, ca. 700–950 m, 7 Apr. 1975, *S. Mori & J. Kallunki 5482* (MO). **Panamá:** Miraflores Annex TTC, beside the laboratory, 31 Aug. 1967, *M. D. Correa 217* (MEXU, MO, NY, PMA); después del Lago Goofy en el camino a Cerro Jefe, 14 Jan. 1968, *M. D. Correa & R. L. Dressler 574* (MO, PMA); Parque Nac. Altos de Campana, recorrido desde Margano, Las Nubes a Trinidad Arriba, Sendero Las Nubes, 11 Apr. 1997, *A. Espinosa 729* (PMA); ca. 5 km de la carr. Llano–Cartí, 1 July 1994, *C. Galdames 1203* (PMA, SCZ); Parque Nac. Altos de Campana, Serranía del Llorón, NW del poblado de Bejuco, 08°41′N, 79°57′W, 600–700 m, 20 Feb. 1998, *C. Galdames 4149* (MO, PMA, SCZ); 08°41′N, 79°56′W, ca. 700 m, 3 Feb. 1999, *C. Galdames 4380* (MO, PMA, SCZ); Cerro Jefe, 800–1000 m, 21 Dec. 1972, *A. Gentry 6789* (MO); ca. 10 km N of Pan-American Hwy. on El Llano–Cartí rd., ca. 500 m, 12 Dec. 1973, *A. Gentry, M. Nee & R. L. Dressler 8885* (MO); El Llano–Cartí rd. ca. 17 km from Pan-American Hwy., 09°15′N, 78°50′W, ca. 400 m, 30 Sep. 1981, *S. Knapp 1354* (MO); along El Llano–Cartí rd., 9.5 km N of Pan-American Hwy., along trail W of rd., 09°15′N, 79°00′W, 200–300 m, 9 Apr. 1987, *G. McPherson 10810* (MO); 4.5 km N of Lago Cerro Azul by rd., vic. of Finca Vega, 675 m, 17 Sep. 1973, *M. Nee 7033* (MO, PMA, US); El Llano–Cartí rd., 13 km from Pan-American Hwy., 300–400 m, 17 Apr. 1981, *K. J. Sytsma 4021* (MO, PMA). **San Blas [Kuna Yala]:** Nusagandi, sede de campo de PEMASKY, 29 Mar. 1992, *R. Paredes 617* (SCZ).

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